MEMORANDUM ON THE IMMEDIATE AFTER EFFECTS OF THE GADGET

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The gadget will heat the air immediately surrounding it to a very high temperature. The sphere immediately heated will reach a temperature of about 1,000,000° and have a radius of about 30 feet. In a very short time of the order of 1/100 of a second this sphere will expand to about 400 ft. radius and cool down to about 15,000°. After this time it will further cool down by emitting radiation and will at the same time rise in the atmosphere. Its size will not change very much.

The ball of fire will rise to the stratosphere (about 15 kilometers height) in about two or three minutes, the motion being fairly uniform. At the end of this time the temperature will have fallen to about 8,000°. If a plane were in the path of this ball of fire it would certainly be destroyed. However because of the small size of the ball of fire and the large distance which the plane can travel before the explosion of the gadget (about 7 miles) the probability of the plane being hit would only be about one in ten thousand even if the ball of fire were equally likely to rise at any point within the seven mile area. Actually the pilot will be able to fly in a direction away from the likely course of the ball of fire which will further reduce the danger to the plane from this source.

The ball of fire will emit considerable light and will have a bluish-white appearance. The greatest fraction of the light will be emitted within the first tenth of a second after explosion. The flash of light obtained in this first instant will be as bright as the sun at a distance of about 100 kilometers from the explosion, provided of course that the observer at this

distance is not behind the horizon. This means that the pilot of the plane should be warned not to look towards the explosion in order not to be blinded. However the general illumination caused by the flash should not be dangerous.

After the initial flash the distance at which the ball of fire appears as bright as the sun goes down rapidly and is about 6/ t kilometers at the time t seconds after the explosion. At a time when it reaches the stratosphere it will still appear as bright as the moon at a distance of about 250 kilometers.

The radioactive materials are expected to be near the center of the ball of fire and rise with that ball of fire to the stratosphere. Presumably the ball of fire will rise to very considerable height (100 kilometers or more) before its rise is stopped by either diffusion or cooling. If the radioactive material ever comes down again it will certainly be spread out over a radius of at least 100 kilometers and probably very much more and will, therefore, be completely harmless. It may however be possible to detect the radioactive material by sensitive instruments, if an when, it comes down. The situation about the radioactive material will of course be different if the gadget is detonated near the surface of the earth, i.e. within 400 ft. of the surface. In this case an appreciable fraction of the radioactivity may come down to the earth and will make the immediate vicinity of the explosion inaccessible for a considerable time.

As regards the plane it will of course be affected also by the blast wave. If the plane is seven miles from the explosion at the time it is reached by the blast wave the pressure of the blast wave will be about

.2 lbs./sq.in. Such a small pressure is not likely to cause serious damage as far as we can see.

Damage to the plane crew from neutrons is not a danger because the altitude of the plane alone is about four times the safe distance for neutron effects.

Copy #2 to J. R. Oppenheimer